Edinburgh Complex Fluids Partnership (ECFP)

A case study in delivering impact for EPSRC-funded soft matter physics

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ECFP grew out of a flagship Programme Grant from the EPSRC to support soft matter physics research in Edinburgh University. We have recently carried out an internal review of the activities of ECFP since its foundation in 2012. This document summarises salient non-confidential findings relevant to the Balancing Capabilities exercise.

The Soft Matter and Biological Physics Group in the School of Physics and Astronomy, Edinburgh University, holds one of the flagship programme grants from the EPSRC, 'Design Principles for New Soft Materials' (EP/J007404/1). It is aimed at uncovering the basic science behind complex fluid formulations used across many industrial sectors. As part of the work of this Programme Grant, the applicants proposed to deliver a framework for translating this new knowledge into the industrial setting that should be sustainable beyond the Programme Grant itself. Interestingly, this concept predated the Government's recent investment in formulation science in the form of the National Formulation Centre (NFC), in response to widespread lobbying from many sources (including an influential 2013 report from the Formulation Special Interest Group of Innovate UK – then TSB, which is already part of the EPSRC's current evidence base).

To deliver this framework, Prof Wilson Poon set up the Edinburgh Complex Fluids Partnership (ECFP) in 2012. All academics in the group are members of ECFP. Its mission is to roll out new fundamental knowledge in soft matter science to enable problem solving and innovation in as many industrial sectors as possible and, in turn, enable industrial practice in these sectors to act as inspiration for new fundamental scientific research (hence the name Edinburgh Complex Fluids *Partnership*). This 'virtuous circle', of course, already operates on many levels through individuals and individual research projects. ECFP aims at facilitating its operation initially on the level of a large Programme Grant, and then eventually on an institutaional or even regional level.

Dr. Tiffany Wood was employed in February 2012 to bring the concept of ECFP to life, and so became the first core staff member of ECFP. Over the last four years, ECFP has become a brand recognized by industry and valued for the world-class expertise of academic staff and unique capabilities within its laboratories. Its turnover has grown from essentially zero to in excess of £0.5M last year, and now sustains two full-time core staff and a number of shorter-term researchers working on industrial consultancy and collaborative research projects. This record demonstrates that there is appetite for input from fundamental soft matter physics to the formulations industry.

Since its foundation in 2012, ECFP has worked with 28 companies, many of which have engaged in consecutive projects with us. Encouragingly, approximately half of the companies we have worked with are small to medium sized enterprises (SMEs), including 3 start-up businesses. Results provided

by ECFP have been instrumental for the success of two of these start-ups. Glycomar is producing a polysaccaride from microalgae which has proven to help combat the signs of aging and engaged with ECFP to understand how to improve their process. In March 2016 the CEO said, *'Analysis provided by ECFP contributed to an overall 50% increase in product yield. Prasintech Ltd, a new joint venture company, has now been formed to manufacture the product*'. In 2012, ECFP supported a startup, Pawsitively Natural, who with ECFP's support built a business from kitchen sink to manufacturing plant within two years to manufacture 'healthy' dog biscuits.

Perhaps the most striking single feature of ECFP's industrial partners to date is the range of sectors they represent (Figure 1), including agrochemicals, pharmaceuticals, personal care, food and drink and fine chemicals. Such diversity illustrates two key points. First, it shows the wide underpinning importance of soft materials across the board of British industry; indeed, it underpins a £180 billion annual formulated products market. Secondly, it is unusual that so many *sectors* choose to work with a single academic department, indeed a single group. Figure 1 therefore illustrates powerfully the value of soft matter *physics*, which studies generic properties of soft materials, so that its intellectual output is in a form that can, in principle, be applied wherever soft materials are found. Conversely, diverse sectors can stimulate fundamental research in soft matter physics.

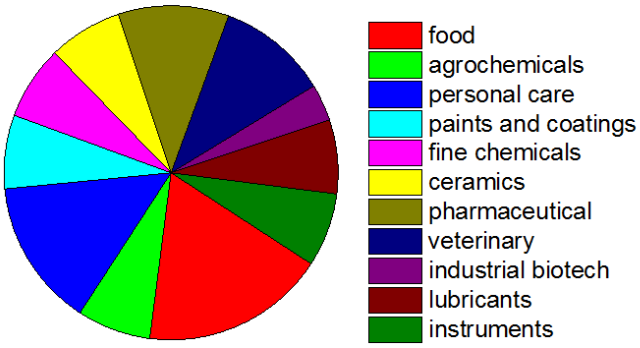

Figure 1: The diverse range of sectors with which ECFP has worked.

One example should illustrate this latter point. The soft matter group in Edinburgh has been at the forefront of a recent revolution in understanding the physics of 'shear thickening' – the phenomenon made famous by the popular science demonstration of 'running on corn starch (solution)'. Interestingly, the attention of the group was first directed to this area of science through working on the flow of concentrated granular suspensions in two apparently rather different sectors: ceramics and confectionaries, and our 'grand synthesis' for understanding the phenomenon is in turn transforming thinking in both industries.

We are certain that the range of sectors represented in Figure 1 is only a subset of the diversity of industries for whom soft matter science plays a key underpinning role. Our plan is to expand into as many of these other sectors as possible, with biotechnology as one of the near-term targets. Many of these new opportunities align with the 'Healthy Nation' outcome of the EPSRC's Delivery Plan, e.g., helping companies use soft matter physics to design low-fat foods without compromising mouth feel.